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(71) Applicant(s)

Robert Bosch GmbH

(Incorporated in the Federal Republic of Germany)

Postfach 30 02 20, D-70442 Stuttgart 30,  
Federal Republic of Germany

(72) Inventor(s)

Istvan Ragaly

(74) Agent and/or Address for Service

A A Thornton & Co

Northumberland House, 303-306 High Holborn,  
LONDON, WC1V 7LE, United Kingdom

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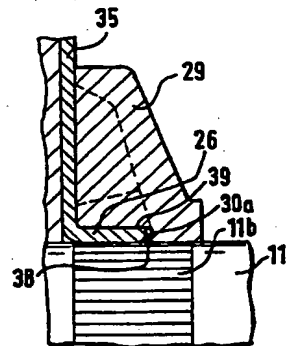
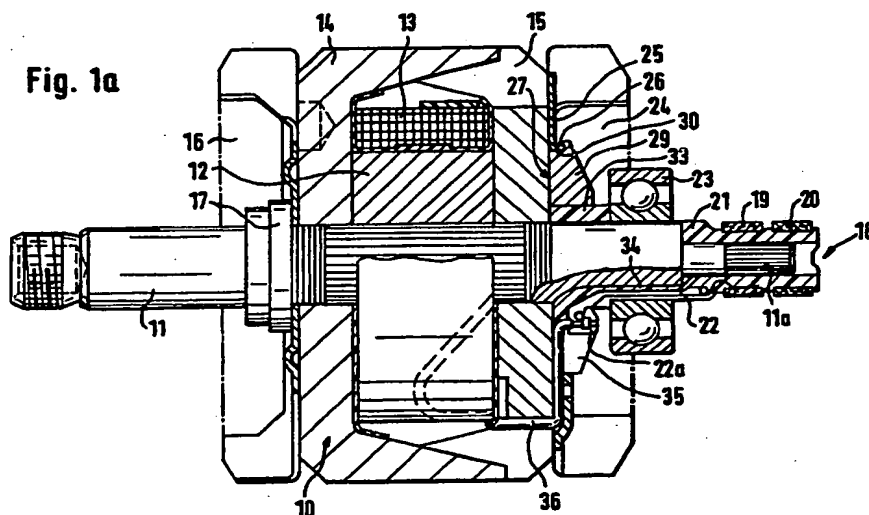
EP 0030725 A2

(58) Field of Search

UK CL (Edition M ) H2A AKA3 AKH2 AKH2A AKK4  
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(54) Securing cooling fan on rotor for electrical machines

(57) A fan (24) provided on fan disc (25) with a collar (26) directed axially away from the front face of the rotor (11), said collar being accommodated in a corresponding axial recess (28) of a supporting disc (29) by press fit. The supporting disc is firmly located, directly or indirectly, on the rotor shaft (11) and presses the fan disc (26) against the front face of the rotor (11) alternatively the collar may also engage the rotor shaft.



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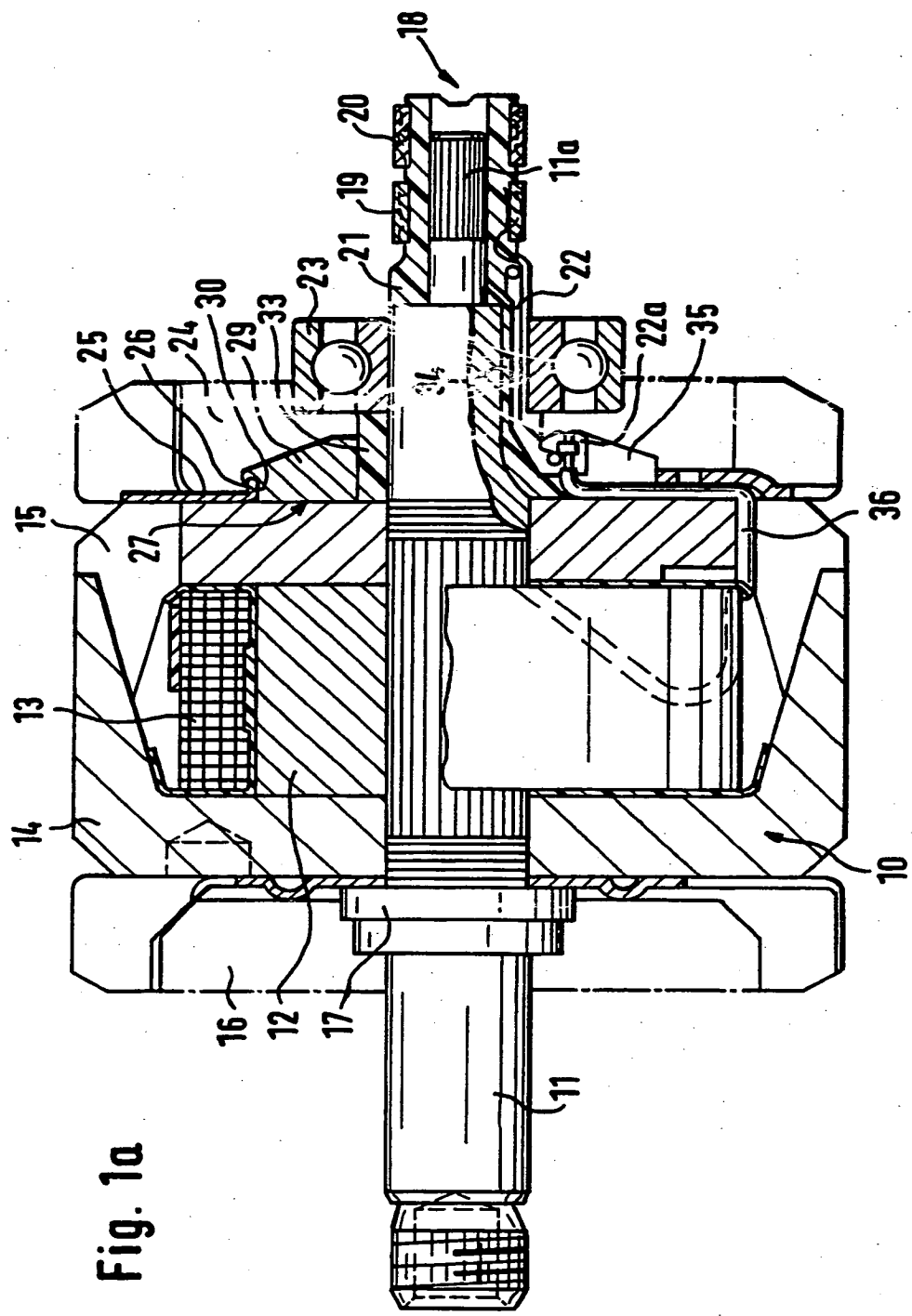


Fig. 1b

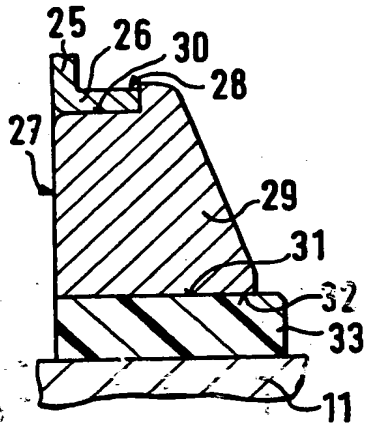


Fig. 4

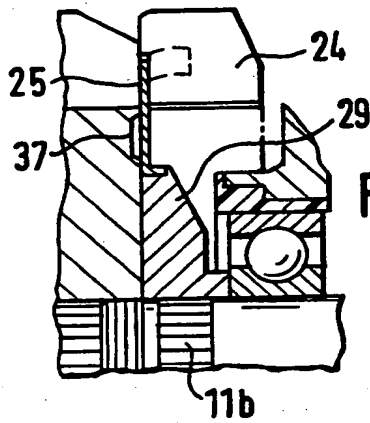
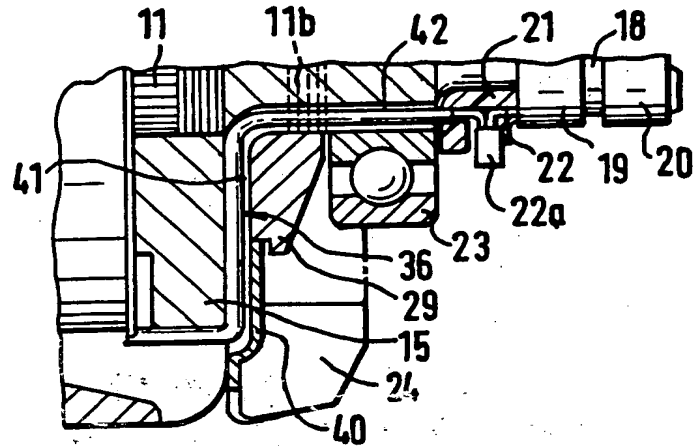


Fig. 2a

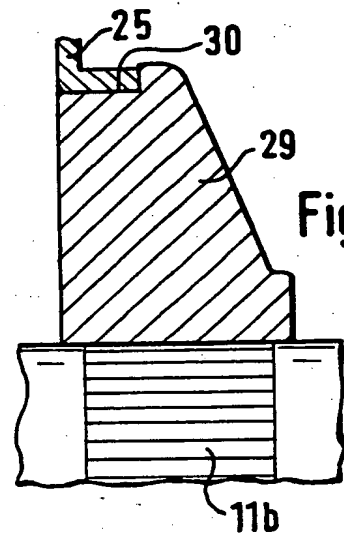


Fig. 2b

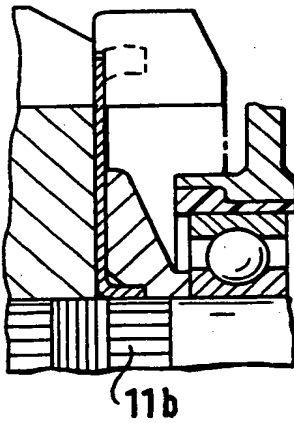


Fig. 3a

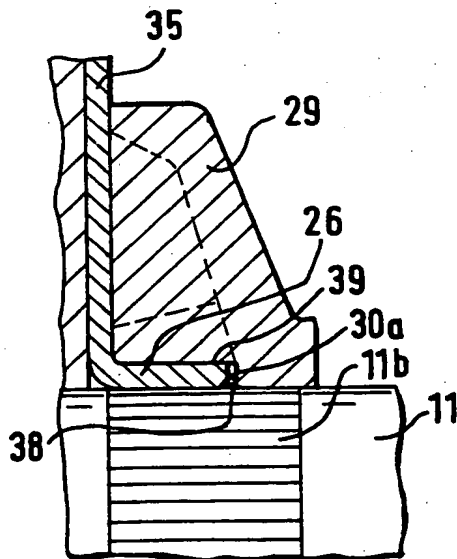


Fig. 3b

## Rotor for Electrical Machines

### State of the Art

The invention takes as starting-point a rotor for electrical machines, in particular claw-pole rotors for three-phase generators with a fan on the slip-ring side according to the preamble to Claim 1.

From DE-GM 88 14 194 such a rotor is already known which bears a fan on each of its two front sides. In this connection the fan on the drive side is mounted onto the rotor shaft via the central bore of its fan disc and is pressed by a supporting disc against the front side of the pole-shoe rotor. In this regard the edge region of the central bore is clamped between rotor and supporting disc. At the end on the slip-ring side the fan arranged there is attached by spot welding to the front side of the claw-pole rotor, and in the centric opening of the fan disc there are arranged on an insulating body connecting lugs of bus bars embedded therein for the connection of the excitation winding of the claw-pole rotor. The insulating body guides the bus bars through under the bearing on the slip-ring side into two hollows of the rotor shaft as far as the slip-ring arrangement which is pushed onto the end of the shaft.

A disadvantage of the known solution is the relatively elaborate attachment of the fan on the slip-ring side by spot welding, which has to be meticulously prepared. Since this

necessitates the use of sheet steel, it causes increased magnetic leakage flux at the claw-pole rotor.

#### Advantages of the Invention

The solution according to the invention with the characterising features of the main claim has the advantage that, due to the welding processes no longer being necessary, the mounting of the fan can be effected more simply and at more favourable cost, whereby by the use of a supporting or receiving disc it is also possible to use inexpensive materials for the fan. This entails the further advantage that with the use of non-magnetic materials, such as aluminium or even synthetic material, the magnetic leakage flux in the region of the fan can be reduced, and hence the power of the generator can be increased.

Advantageous further developments of and improvements to the characteristics specified in the main claim result from the measures cited in the subclaims.

#### Drawing

A number of examples of embodiments of the invention are represented in the drawing and elucidated in greater detail in the following description. Figure 1a shows a claw-pole rotor with fans on either side in longitudinal section, Figure 1b shows an enlarged detail of the fan on the slip-ring side, Figure 2 shows by way of additional exemplary embodiment the upper half of the fan on the slip-ring side in longitudinal section and Figure 2b shows an enlarged representation of a fan detail.

Figure 3a shows by way of third exemplary embodiment the upper half of a fan on the slip-ring side in longitudinal section and Figure 3b shows an enlarged detail thereof. Figure 4 shows by way of fourth exemplary embodiment the lower half of

the end on the slip-ring side of a claw-pole rotor in longitudinal section.

#### Description of the Exemplary Embodiments

In Figure 1a a claw-pole rotor for a three-phase generator for the electrical power supply of a motor vehicle is designated as 10. On its rotor shaft 11 there are attached a conducting piece 12 with excitation winding 13 arranged thereon and on both sides thereof two claw-pole plates 14, 15. On the front face on the drive side of the claw-pole plate 14 there is located a sheet-metal fan 16 which is clamped in the shaft region of a steel disc 17 pressed onto the rotor shaft 11. On the opposite end 11a of the rotor shaft 11 there is mounted a slip-ring arrangement 18 consisting of two slip rings 19 and 20 located axially side by side and a carrier body 21 made of insulating material in which two connecting leads 22 for the slip rings 19, 20 are embedded. Located behind these is a ball bearing 23, and between said ball bearing 23 and the claw-pole plate 15 an additional sheet-metal fan is arranged on the front face of the rotor 11 on the slip-ring side.

The attachment of this sheet-metal fan 24 on the slip-ring side is effected without its fan disc 25 being welded onto the front face of the rotor 11 in which the fan disc 25 exhibits a collar 26 directed axially away from the front face of the rotor 11 at the central opening 27 of the fan disc 25. This collar 26 is accommodated in a corresponding axial recess 28 of a supporting disc 29 by a press fit 30, as can be seen on an enlarged scale in Figure 1b. The supporting disc 24 is in turn attached by its inner bore 32 via a press fit 31 on a ring 33 of insulating material seated firmly on the rotor shaft 11. In this connection the ring 33 of insulating material is connected to the slip-ring arrangement 18 by means of the bridges 34 of insulating material which each contain a connecting lead 22 and which, accommodated in corresponding hollows of the rotor shaft 11, are guided through under the

ball bearing 23 on the slip-ring side. In Figure 1, in the lower half, only one of the two connecting leads 22 located opposite one another is represented, whereby the connecting lead 22 with its connecting lug 22a is arranged in a corresponding recess 35 of the supporting plate 29 and is in contact with the end of a connecting line 36 of the excitation winding 13. In this regard the connecting line 36 is located in a bead of the fan disc 25 which runs radially.

By way of additional exemplary embodiment, in Figures 2a and 2b the fan 24 on the slip-ring side is attached to the supporting disc 29 in accordance with the first exemplary embodiment, but said supporting disc here is pressed directly onto a knurled region 11b of the rotor shaft 11. As an additional safeguard against torsion of the fan disc there are provided there on the front face of the rotor 11 knurled or toothed regions 37 distributed over the periphery, into which the fan disc 25 is pressed axially. In addition to or instead of this, the fan disc on the front face of the rotor can also be adhesion-bonded to the front side by means of impregnating resin or other suitable adhesives.

In the exemplary embodiment according to Figures 3a and 3b the fan disc 25 of the sheet-metal fan 24 is pressed directly by its axial collar 26 onto a knurled or grooved region 11b of the rotor shaft 11 in the region 30a. In addition, the collar 26 here is attached within the corresponding inner recess 38 of the supporting disc 29 by press fit 39.

In the exemplary embodiment according to Figure 4, which represents the lower half of the fan according to Figure 2a in longitudinal section, the connecting line 36 of the excitation winding 13 is firstly guided in a radial bead 40 in the fan disc 25, then in a hollow 41 of the supporting disc 29 and in a hollow 42 of the rotor shaft as far as the slip-ring arrangement 18. There the connecting line is in each case brought into contact with a connecting lug 22a of the

connecting lead 22 embedded in the carrier body 21 for the slip rings 19, 20. In this regard the connecting lugs 22a are bent outwards in the axial direction, acting as fan blades.

With a view to increasing the bending strength it is possible, if the need arises, for the fan disc 25 also to be provided with additional beads distributed over the periphery. Instead of a rotor made of sheet steel the latter can also be manufactured from aluminium or from another magnetically inactive material, with the advantage thereby of reducing the leakage fluxes at the rotor and of increasing the power of the generator. The relocation of the junction of the connecting lines 30 of the excitation winding 13 with the connecting lines 22 of the slip-ring arrangement 18 out of the region of the fan (Figure 1a) towards the carrier body 21 for the slip-ring arrangement 18 according to Figure 4 has the advantage of simpler manufacture of the supporting disc 29 of the fan 25 and of the slip-ring arrangement 18 together with the connecting lugs 22a for the cooling of the slip rings 19, 20.

## Claims

1. Rotor for electrical machines, in particular claw-pole rotors for three-phase generators in motor vehicles with a rotor winding to be supplied via a slip-ring arrangement mounted on the end of a rotor shaft and with at least one sheet-metal fan arranged on the front face of the rotor on the slip-ring side, characterised in that the sheet-metal fan (24) with its fan disc (25) exhibits a collar (26) directed axially away from the front face of the rotor (11) at the central opening (27) of the fan disc (25), said collar being accommodated within a corresponding axial recess (28) of a supporting disc (29) by press fit (30), whereby said supporting disc is firmly located on the rotor shaft (11) and presses the fan disc (25) against the front face of the rotor (11).

2. Rotor according to Claim 1, characterised in that the rotor disc (25) is adhesion-bonded to the front face of the rotor (11).

3. Rotor according to Claim 1 or 2, characterised in that with a view to additional protection against torsion the fan disc (25) is pressed into knurled or toothed regions (37) of the front face of the rotor (11).

4. Rotor according to one of the preceding claims, characterised in that the rotor disc (25) with its axial collar (26) is pressed onto a knurled or grooved region (11b) of the rotor shaft (11).

5. Rotor according to one of the preceding claims, characterised in that the axial collar (26) of the rotor disc (25) is pressed into a recess (28) on the outer periphery of the supporting disc (29).
6. Rotor according to Claim 5, characterised in that the supporting disc (29) is attached by its inner bore (32) by press fit (31) to a ring (33) made of insulating material located on the rotor shaft (11), said ring being connected to the slip-ring arrangement (18) by means of bridges (34) containing connecting leads (22).
7. Rotor according to Claim 1, characterised in that the connecting lines (36) of the excitation winding (13) are guided in radial beads (40) in the fan disc (25) and in hollows (41, 42) of the supporting disc (29) and of the rotor shaft (11) as far as the slip-ring arrangement (16) and in each case are brought into contact there with a connecting lug (22a) of connecting lines (22) embedded in the carrier body (21) for the slip rings (19, 20).
8. Rotor according to Claim 7, characterised in that the connecting lugs (22a) are bent outwards in the axial direction as fan blades.
9. Any of the rotors substantially as herein described with reference to the accompanying drawings.

Patents Act 1977  
Examiner's report to the Comptroller under Section 17  
(The Search report)

8

Application number  
GB 9419177.2

Relevant Technical Fields

- (i) UK Cl (Ed.M) H2A (AKK4, AKA3, AKH2A, AKH2)  
(ii) Int Cl (Ed.5) HO2K 09/06, 13/02; H01R 39/08, 39/16, 39/34

Databases (see below)

- (i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Search Examiner  
J COCKITT

Date of completion of Search  
17 NOVEMBER 1994

Documents considered relevant  
following a search in respect of  
Claims :-  
1-5

Categories of documents

- X: Document indicating lack of novelty or of inventive step. P: Document published on or after the declared priority date but before the filing date of the present application.
- Y: Document indicating lack of inventive step if combined with one or more other documents of the same category. E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.
- A: Document indicating technological background and/or state of the art. &: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
A	EP 0030725 A2 (NIPPONDENSO)	

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